Abstract

Information provided by an agent affects prices at which equity transactions take place. The agent may breach his duty either by spending too little effort at investigating relevant matters or by manipulating the obtained information unduly. As a consequence of such breach of duty, market participants may suffer from losses. Legal systems provide a rather disparate array of remedies without providing a coherent theory that would support the design of these remedies. The present paper propagates a general principle according to which courts may award expectation damages and it identifies sufficient conditions under which such damages would generate incentives for the agent to investigate with due care and to disclose the information duly.

JEL classification: K13, K12, D62

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1 Introduction

Issuers and their agents such as auditors and rating agencies provide information to markets that may affect quantities and prices of equity transactions. At the time trade takes place, markets see the information as disclosed by the agent but cannot observe its intrinsic quality. Think of real estate owned by the company or think of the potential of a new drug. The agent may provide an estimate of the real estate’s value or of the drug’s expected medical success. Since markets cannot observe the effort behind such estimates they have to rely on the agent to meet his legal duties, be it under contract or tort law.

Breach of duty in corporate disclosure results from insufficient care in acquiring information or from disclosing information untruthfully and from withholding relevant information unduly. As a consequence of such breach of duty, market participants may suffer a loss and may be entitled to damages. Harm from such breach of duty typically corresponds to pure economic losses, for which many tort laws grant recovery only in exceptional cases. In Germany, e.g., pure economic losses can be recovered if the injurer’s behavior was intentionally immoral, a standard far beyond mere negligence.

In addition to general rules from tort and contract law, legal systems provide remedies that are specific for transactions on equity markets. On primary markets, the victim is granted restitution damages as a remedy if the faulty information concerns an issue that has caused a fall in prices or even if the faulty information, without affecting the price, has just caused the victim to buy the equity.

On secondary markets, the issuer of equity can be held liable for withholding relevant insider information or for disseminating such information falsely. In such cases, the issuer must pay expectation damages to the victim even in cases of pure economic loss.

As a necessary condition for damages to be granted, the agent’s breach of duty must have been the cause-in-fact for the loss. If the answer to the

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1 For details concerning the German legal system, see Wagner (2008).
2 “Vorsätzliche Sittenwidrigkeit”, § 826 BGB (German Civil Code).
3 In Germany, liability according to § 44 I BörsG (Börsengesetz) may lead to restitution under certain circumstances.
4 In Germany, § 37 b II, WpHG (Wertpapierhandelsgesetz).
question "but for the agent’s breach of duty, would the loss have occurred?" happens to be no then the but-for test would be satisfied and the breach would be considered to be the cause-in-fact of the loss.

Both expectation damages and the but-for test refer to the purely hypothetical situation where the agent had acted with due care, which actually he has not. Yet, even from the ex post perspective when courts are called in, the hypothetical situation may still remain uncertain. Stock prices may or may not have fallen or the drug’s success may or may not be as predicted even if the agent had duly investigated and disclosed. Courts have to cope with such hypothetical uncertainty.

By adhering to the all-or-nothing approach – either the victim fully recovers or she is denied any recovery – courts tend to aggravate their challenge. In fact, the all-or-nothing approach turns out to be at odds with the compensation principle as envisaged by the verbal definition of expectation damages. Accordingly, the quantum of expectation damages is such sum of money that will put the victim or creditor as nearly as possible into the position in which she would have been if the obligation had been duly performed. While, in the absence of uncertainty, legal scholars insist on the compensation principle being met they are more reluctant to maintain the principle under hypothetical uncertainty.

I shall argue, even under hypothetical uncertainty, strictly in favor of the compensation principle by awarding correct expectation damages which, for lack of information, may have to be taken on average over the observed event.\(^5\) The present paper discusses how such expectation damages could be calculated and what would be the agent’s incentives not only for acquiring information with sufficient care but also for disclosing it duly to the market if, for deviations, he will be held liable along these lines.

Legal duties, in general, serve as reference point for quantifying expectation damages and the but-for test. Moreover, if unobservable activities of information agents are at stake, legal duties may also guide beliefs as markets rely on the agent to meet his duty. For such beliefs to be rational, the appropriate incentive constraints must be met which, in turn, depend on the

\(^5\)In Schweizer (2009), I have introduced the notion of correct damages on average over the observed event for malpractice suits. The same notion proves useful for the present setting concerning transactions on equity markets as well.
damages regime in place. The agent’s duty is called implementable under the damages regime in place, if the agent has the incentive to meet his duty under this regime.

Implementability is shown to be closely related to duties being constrained efficient in the following sense. Equity trade may be distorted by market imperfections. Damages regimes cannot be expected to cure such market distortions. The most we can ask for is that social surplus will be maximized subject to additional constraints. The agent’s duty is called constrained efficient provided that, if kept, it would maximize social surplus in the constrained sense.

Damages regimes meeting the compensation principle exhibit the nice property that constrained efficient duties become implementable. Expectation damages if granted on average over observed events satisfy the compensation principle and, hence, allow implementing constrained efficient duties quite generally. Damages under the all-or-nothing approach and restitution, in contrast, will both turn out to be at conflict with the compensation principle and to distort the agent’s incentives.

To study constrained efficient duties, a traditional model of trade with the following extra features is introduced. Ex ante, the shapes of demand and supply functions are uncertain. An agent is spending effort to collect relevant information which he then discloses to the market. Markets rely on the agent to search for information with sufficient care and to disclose it duly. As a consequence, the market outcome will depend on the information as disclosed by the agent. While the legal background of corporate disclosure serves as institutional guideline, the analysis is applicable far beyond.

The present paper departs from and is related to many contributions from the existing literature. Hirshleifer (1971) introduced the distinction between the private and the social value of information. The focus of the present paper will be on information having social value. Kronman (1978) argued that allocative efficiency is promoted by getting information to the market as quickly as possible. Yet, denying a property right in deliberately acquired information will discourage the search for information. The present paper directly focuses at disclosure duties that are (constrained) efficient.

Shavell (1994) explores the involved trade-off in a seller-buyer relationship. If information is socially valuable then its disclosure is desirable. More-
over, sellers will have the correct incentive to acquire information even when required to disclose it. For buyers to have any incentive of acquiring information at all, they must be given a property right in deliberately acquired information. But if they have this right, their incentives to search for information may be excessive. No general statement is possible as to whether requiring buyers to disclose would be efficient or not.

Shavell assumes that agents disclose their information truthfully if they are required to do so. The present paper, in contrast, takes incentives to disseminate information in line with the disclosure duty into account.

Schäfer (2004) also deals with a topic that is related to the present paper. He argues that an auditor’s liability has a different function in primary and in secondary capital markets. Auditors observe the true state of the world with higher probability if they exert more effort. Yet, again, if auditors happen to observe the true state of the world, they will disclose it honestly. In contrast to the present paper, Schäfer neglects the incentives to do so.

The present paper is organized as follows. Section 2 introduces a simple setting with two states of the world and two signals whose precision depends on the agent’s unobserved effort. Propositions are established dealing with the implementation of constrained efficient duties. They are based on compensatory properties of the damages regime in place and hold far beyond the simple setting of section 2.

Section 3 explores the existence of constrained efficient duties. Due to trade distortions, checking for constrained efficiency may be quite demanding. A single crossing property is identified which simplifies the task.

Section 4 compares restitution versus expectation damages with and without hypothetical uncertainty. Even if the hypothetical signal were known, restitution damages violate the compensation principle and, hence, distort the agent’s incentives. If the hypothetical signal remains uncertain, the all-or-nothing approach if combined with a causality test also fails to satisfy the compensation principle and the agent’s incentives will be distorted as well. Only if expectation damages were granted on average over the observed event, the agent has the incentive to meet constrained efficient duties.

Section 5 introduces a richer version of the model and establishes that correct expectation damages on average over the observed event allow to implement constrained efficient duties quite generally. Section 6 concludes.
2 A simple model

The true but unknown state of the world is either $S = L$ or $S = H$. Ex ante, state $S = H$ is expected to occur with probability $\mu$ and state $S = L$ with probability $1 - \mu$. In state $S$, the indirect demand and supply functions are $p = F^S(q)$ and $p = G^S(q)$, respectively. Indirect demand is interpreted as marginal utility and indirect supply as marginal costs from which utility and cost functions are obtained by integration:

$$V^S(q) = \int_0^q F^S(y) \cdot dy \quad \text{and} \quad K^S(q) = \int_0^q G^S(y) \cdot dy$$

Social welfare then amounts to $W^S(q) = V^S(q) - K^S(q)$.

An agent in charge of acquiring and disclosing additional information observes signal $s \in M = \{l, h\}$. In state $S = L$ ($S = H$) the signal $s = l$ ($s = h$, respectively) is called the correct signal. At effort costs $c(x)$ the correct signal is observed with probability $x$ where $x \in [1/2, 1]$. Precision $x = 1/2$ would prevail under tossing a coin. To be informative, the precision must be from the range $x > 1/2$. The cost function $c(x)$ is assumed increasing in $x$ whereas full precision $x = 1$ is infinitely costly. Expressed in Kronman’s (1978) terminology, the agent is deliberately acquiring information.

The signal allows to update beliefs. If the true signal $s = h$ is observed then

$$\mu_h(x) = \text{prob} \{S = H : s = h\} = \frac{\mu \cdot x}{\mu \cdot x + (1 - \mu) \cdot (1 - x)}$$

whereas, if signal $s = l$ is observed then

$$\mu_l(x) = \text{prob} \{S = H : s = l\} = \frac{\mu \cdot (1 - x)}{\mu \cdot (1 - x) + (1 - \mu) \cdot x}.$$ 

For any $x > 1/2$, $\mu_l(x) < \mu < \mu_h(x)$ must hold. Moreover, $\mu_l$ is decreasing whereas $\mu_h$ is increasing in $x$, i.e. $d\mu_l/dx < 0 < d\mu_h/dx$. At signal $s \in M$, the expected welfare amounts to

$$w_s(x, q) = \mu_s(x) \cdot W^H(q) + (1 - \mu_s(x)) \cdot W^L(q) \quad (1)$$

if quantity $q$ is traded.

The agent may but need not disclose truthfully. His disclosure strategy is denoted by the function $\sigma : M \to M$ where $s' = \sigma(s)$ denotes the signal he discloses if he actually has observed signal $s$. Since there are two possible
signals, there exist four different disclosure strategies: first, telling the truth
\(\sigma^*(s) \equiv s\); second, \(\sigma(s) \equiv h\); third, \(\sigma(s) \equiv l\); fourth, misrepresenting the
truth \(\sigma^m(h) = l\) and \(\sigma^m(l) = h\). Notice, the second and third strategy fail to be informative whereas the first and the fourth strategy are equally informative.

If the agent were known to investigate with precision \(x\) and to use disclosure strategy \(\sigma\), the market would believe state \(S = H\) to occur with probability \(m_s(x, \sigma)\) whenever signal \(s\) has been disclosed. For such believes to be rational, the following conditions must hold:

\[
m_s(x, \sigma \equiv h) = m_s(x, \sigma \equiv l) = m_s \left( \frac{1}{2}, \sigma \right) = \mu
\]

and

\[
m_s(x, \sigma^*) = m_{s'}(x, \sigma^m) = \mu_s(x)
\]

where \(s' = l\) and \(s' = h\) if \(s = h\) and \(s = l\), respectively. In other words, if the agent’s disclosure strategy fails to be informative or if he is just tossing coins, markets stick to their ex ante beliefs. If, however, the agent’s disclosure strategy is informative markets update their beliefs in line with Bayes’ rule.

Under the damages regime in place, it is the agent’s duty to investigate with precision \(x^o\) and to disclose according to strategy \(\sigma^o\). This duty affects the outcome in two ways. It serves as focal point because markets are assumed to believe that the agent is meeting his duty. It further serves as reference point for calculating damages and for ascertaining causality.

Therefore, if the agent discloses signal \(s\) then the market believes state \(S = H\) to occur with probability \(m_s^o = m_s(x^o, \sigma^o)\) and, if market structure \(n\) is in place (in the numerical example below, \(n\) corresponds to the number of Cournot competitors in the market), then quantity

\[
q^o_s = q^n(m_s(x^o, \sigma^o))
\]

will be traded at price \(p^o_s = p^n(m^o_s)\).

The agent may deviate either by investigating with insufficient effort \(x < x^o\) or by disclosing according to \(\sigma \neq \sigma^o\) (or both). Under such a deviation, the social surplus as expected ex ante amounts to

\[
\gamma(x, \sigma; x^o, \sigma^o) = w \left( x, q^o_{\sigma(l)}, q^o_{\sigma(h)} \right) - c(x)
\]
where
\[
    w(x, q_l, q_h) = \mu \cdot x \cdot W^H(q_h) + \mu \cdot (1 - x) \cdot W^H(q_l) + (1 - \mu) \cdot x \cdot W^L(q_l) + (1 - \mu) \cdot (1 - x) \cdot W^L(q_h).
\]

denotes the surplus if quantity \( q_s \) is traded whenever the true signal is \( s \).

Notice, at the time parties decide on trade, the deviation is still hidden to the market and, hence, the quantity traded would remain to be (2).

The agent’s duty is called \textit{constrained efficient} if it solves
\[
    (x^o, \sigma^o) \in \arg \max_{(x,\sigma)} \gamma(x, \sigma; x^o, \sigma^o)
\]
and it is called \textit{non-trivial} if it is the agent’s duty to investigate with precision \( x^o > 1/2 \). Notice, for a non-trivial duty to be constrained efficient, the disclosure strategy must be informative.

The trivial duty not to investigate, i.e. \( x^o = 1/2 \) is always constrained efficient. In fact, if the market expects the agent not to investigate, the traded quantity \( q = q^n(\mu) \) will be based on the ex ante probability and, hence, the expected social benefit
\[
    w(x, q, q) = \mu \cdot W^H(q) + (1 - \mu) \cdot W^L(q)
\]
will not depend on the agent’s activities. Under such circumstances it would be constrained efficient indeed not to spend effort on a more precise signal.

At the other extreme, consider the first best solution. Let
\[
    q^*_s(x) \in \arg \max_q w_s(x, q)
\]
denote the quantity which maximizes social surplus given that the agent has investigated with effort \( x \) and has observed the true signal \( s \). The first best effort level then solves
\[
    x^* \in \arg \max_x w(x, q^*_l(x), q^*_h(x)) - c(x).
\]
Therefore, given the agent’s duty to investigate at effort level \( x^* \) and to disclose truthfully, the market would enact trade \( q^o = q^*_s(x^*) \) whenever the agent has disclosed signal \( s \). It follows that the agent’s strategy \( (x^*, \sigma^*) \) maximizes the expected social surplus \( \gamma(x, \sigma; x^*, \sigma^*) \) over all effort levels \( x \) and disclosure strategies \( \sigma \). Therefore, the duty to invest at the first best level
and to disclose truthfully is constrained efficient provided that markets are not distorted (perfect competition).

Under trade distortions, however, the trivial duty may well turn out to be the only constrained efficient solution. The notion of constrained efficiency will be further explored in the next section.

The agent’s duty \((x^o, \sigma^o)\) also plays a role for the damages regime in place. Ex post, courts are assumed to detect deviations \((x, \sigma)\) from the agent’s duty and to quantify damages accordingly. Let \(\psi = \psi(x, \sigma; x^o, \sigma^o)\) denote the expected payoff (including damages awards) of all parties other than the agent and let \(\phi = \phi(x, \sigma; x^o, \sigma^o)\) denote the agent’s payoff (net of damages liability). The agent may or may not have stakes of his own in producers’ or consumers’ surplus. Costs of operating the legal system are neglected such that

\[
\gamma(x, \sigma; x^o, \sigma^o) = \phi(x, \sigma; x^o, \sigma^o) + \psi(x, \sigma; x^o, \sigma^o)
\]

will hold. The explicit specification of damages will be discussed in subsequent sections.

For the agent’s duty to be \textit{implementable under the damages regime in place}, the agent must have the incentive to meet his duty, i.e. his duty must solve

\[
(x^o, \sigma^o) \in \arg \max_{(x, \sigma)} \phi(x, \sigma; x^o, \sigma^o).
\]

Moreover, the beliefs of the market must be rational given that the agent meets his duty, i.e. \(m^o = m^o(x^o, \sigma^o)\) must also hold. By looking at the other parties’ net payoffs, the following two propositions allow to check for implementability.

A damages regime satisfies the \textit{compensation principle} if

\[
\psi(x, \sigma; x^o, \sigma^o) \geq \psi(x^o, \sigma^o; x^o, \sigma^o)
\]

holds for any deviation \((x, \sigma)\) from the agent’s duty \((x^o, \sigma^o)\). The damages regime is said to generate \textit{monotonic payoffs} if either \(\psi_x(x, \sigma^o; x^o, \sigma^o) > 0\) holds for all effort levels \(x \geq x^o\) or \(\psi_x(x, \sigma^o; x^o, \sigma^o) < 0\) holds for all \(x \leq x^o\).

\textbf{Proposition 1} If a damages regime generates monotonic payoffs then non-trivial constrained efficient duties can never be implemented under such a regime.
Proposition 2 If a damages regime satisfies the compensation principle then any constrained efficient duty can be implemented under such a regime.

Proof. To establish the first proposition, suppose \( \psi_\alpha(x) = \psi_\alpha(x, \sigma^o; x^o, \sigma^o) > 0 \) holds for all effort levels \( x \geq x^o \). For effort levels in the range \( x^o < x \), it follows that \( \psi(x^o) < \psi(x) \) must hold. If the duty were constrained efficient, \( \gamma(x^o) \geq \gamma(x) \) would have to hold from which it would follow that \( \phi(x) < \phi(x^o) \) must hold. Therefore, the agent’s optimal effort cannot be from the range \( x^o < x \).

If the duty is non-trivial it can neither be optimal for the agent to meet his duty. In fact, if the duty is non-trivial it follows that \( \gamma(x) = 0 \) and, hence, that \( \phi(x) = 0 - \psi(x^o) < 0 \) must hold. The agent would have the incentive to investigate with precision strictly below due effort \( x^o \) indeed. Therefore a constrained efficient duty cannot be implemented under the damages regime in place if the duty is non-trivial. This establishes the first claim of Proposition 1. The second claim can be established by a symmetric argument.

To prove the second proposition, suppose the agent’s duty is constrained efficient. It follows that \( \gamma(x, \sigma; x^o, \sigma^o) \leq \gamma(x^o, \sigma^o; x^o, \sigma^o) \) must hold for any deviation \( (x, \sigma) \neq (x^o, \sigma^o) \). Since the compensation principle is met, \( \psi(x, \sigma; x^o, \sigma^o) \geq \psi(x^o, \sigma^o; x^o, \sigma^o) \) and, hence,

\[
\phi(x, \sigma; x^o, \sigma^o) = \gamma(x, \sigma; x^o, \sigma^o) - \psi(x, \sigma; x^o, \sigma^o) \leq \\
\leq \gamma(x^o, \sigma^o; x^o, \sigma^o) - \psi(x^o, \sigma^o; x^o, \sigma^o) = \phi(x^o, \sigma^o; x^o, \sigma^o)
\]

must hold for any deviation \( (x, \sigma) \). Therefore the agent has indeed the incentive to meet his duty if it is constrained efficient and if the compensation principle is met. The second proposition is established as well. ■

For illustration, the following numerical specification of the above model will be revisited throughout the paper. Ex ante, both states are equally likely, i.e. \( \mu = 1/2 \). The indirect demand function \( F^S(q) = A^S - q \) is linear and only its intercept \( 0 < A^L < A^H \) though not its slope is uncertain. Marginal costs are constant and known such that they can be normalized to zero, i.e. \( G^L(q) = G^H(q) \equiv 0 \). Social welfare in state \( S \) amounts to \( W^S(q) = V^S(q) = A^S \cdot q - q^2/2 \).

If signal \( s = h \) occurs then the updated probability of state \( S = H \) amounts to \( \mu_h = x \) whereas at signal \( s = l \) the updated probability of state \( S = H \) is \( \mu_l = 1 - x \).
Moreover, suppose market exchange is governed by Cournot quantity competition among \( n \) suppliers. Since production costs are assumed to vanish, quantity and price amount to

\[
q^n(m) = \frac{n}{n+1} \cdot a(m) \quad \text{and} \quad p^n(m) = \frac{1}{n+1} \cdot a(m)
\]

where \( a(m) = m \cdot A^H + (1 - m) \cdot A^L \) denotes the expected intercept if markets believe state \( S = H \) to occur with probability \( m \). Notice, if \( n = 1 \), the solution corresponds to the monopoly outcome whereas, if \( n \to \infty \), the solution approaches perfect competition. Constrained efficient duties in general and for the numerical example in particular will be explored in the next section.

3 Constrained efficient duties

By definition, the duty \((x^o, \sigma^o)\) is constrained efficient if it maximizes the expected social surplus \( \gamma(x, \sigma) = \gamma(x, \sigma; x^o, \sigma^o) \) as defined in the previous section. The present section explores the existence of non-trivial duties that are constrained efficient. Recall, for the duty \((x^o, \sigma^o)\) to be non-trivial, the due effort level must be from the range \( \frac{1}{2} < x^o \). Moreover, to ensure constrained efficiency, the information strategy \( \sigma^o \) must be informative which, in the present setting, means without loss of generality that the agent discloses truthfully. For this reason, in the present section, the agent’s disclosure duty is assumed to be \( \sigma^*(s) \equiv s \).

Markets believe the agent to meet such duty. Therefore, if the agent discloses signal \( s \) the quantity \( q^o_s = q^n(m_s(x^o, \sigma^*)) \) will be traded under market structure \( n \). Moreover, if he actually meets his duty the expected social surplus amounts to \( \gamma(x^o, \sigma^*) \) and, hence, for the agent’s duty to be efficient, the following two conditions must be met (for the definition of \( w \), see (3)):

\[
\gamma(x^o, \sigma^*) = w(x^o, q^o_l, q^o_h) - c(x^o) \geq \max_x w(x, q^o_l, q^o_h) - c(x) \quad (4)
\]

and

\[
\gamma(x^o, \sigma^*) \geq \max_x w(x, q^o_h, q^o_l) - c(x) \quad (5)
\]

These two conditions require that no effort level and no informative disclosure strategy allow to increase the social surplus beyond \( \gamma(x^o, \sigma^*) \).
Obviously, disclosure strategies that fail to be informative are cheapest at tossing a coin. Therefore, for the agent’s duty to be constrained efficient

\[ \gamma(x^o, \sigma^*) \geq w\left(\frac{1}{2}, q^o_l, q^o_r\right) - c \left(\frac{1}{2}\right) \]  

(6)

and

\[ \gamma(x^o, \sigma^*) \geq w\left(\frac{1}{2}, q^o_l, q^o_r\right) - c \left(\frac{1}{2}\right) \]  

(7)

must also be met. The agent’s duty \((x^o, \sigma^*)\) is constrained efficient if and only if \((4) - (7)\) are satisfied.

If a market structure is in place that distorts trade checking the constrained efficiency of the agent’s duty becomes quite intricate. To simplify, let us assume that the single crossing property

\[ \frac{dW^H(q)}{dq} > \frac{dW^L(q)}{dq} \]

is met for all quantities \(q\). Then the following proposition can be established.

**Proposition 3** Suppose the single crossing property is met and \(q^o_l \leq q^o_h\) holds. Then the agent’s (non-trivial) duty is constrained efficient if and only if conditions \((4), (6)\) and \((7)\) are met. In other words, \((5)\) need not be checked.

**Proof.** Since

\[ \frac{\partial w_s(x, q)}{\partial q \partial x} = \left[ \frac{dW^H(q)}{dq} - \frac{dW^L(q)}{dq} \right] \cdot \frac{d\mu_s}{dx} \]

it follows from the single crossing property that

\[ \frac{\partial^2 w_h}{\partial x \partial q} > 0 > \frac{\partial^2 w_l}{\partial x \partial q} \]

must hold (for the definition of \(w_s\), see \((1)\)). Moreover, since \(q^o_l \leq q^o_h\), it follows that

\[ \frac{\partial w_h(x, q^o_l)}{\partial x} \geq \frac{\partial w_h(x, q^o_r)}{\partial x} \quad \text{and} \quad \frac{\partial w_l(x, q^o_l)}{\partial x} \geq \frac{\partial w_l(x, q^o_r)}{\partial x} \]

must also hold.

If \(w_h(1/2, q_h) = w(1/2, q_h, q_h) \geq w_h(1/2, q_l) = w(1/2, q_l, q_l)\) then

\[ w_h(x, q_h) \geq w_h(x, q_l) \]

(12)
must hold for all \( x \). Similarly, if \( w_l(1/2, q_l) = w(1/2, q_h, q_h) \leq w_l(1/2, q_h) = w(1/2, q_l, q_l) \) then \( w_l(x, q_l) \geq w_l(x, q_h) \) must hold for all \( x \). In other words, the disclosure strategy \( \sigma^m \) can never be constrained efficient and, for that reason, (5) need not be checked.

For illustration, let me look at the numerical example again and suppose effort costs \( c(x) \) are a differentiable and convex function of the effort level \( x \). Then the first order condition

\[
\frac{\partial w(x^o, q^o_l, q^o_h)}{\partial x} = \frac{n}{n+1} \cdot (2x^o - 1) \cdot \left( A^H - A^L \right)^2 = \frac{dc(x^o)}{dx} \tag{8}
\]

is necessary and sufficient for condition (4) to be met. Notice, the term on the left is linearly increasing in \( x^o \) whereas \( dc(x^o)/dx \) is increasing as well and, hence, the above equation may allow for several solutions. Not all of them, however, need to be constrained efficient.

To check for the remaining conditions, notice that

\[
w\left( \frac{1}{2}, q^o_l, q^o_h \right) - w\left( \frac{1}{2}, q^o_l, q^o_h \right) = \frac{q^o_h - q^o_l}{2(n + 1)} \cdot \left( A^H + A^L \right) > 0
\]

holds such that condition (7) is the remaining one to be checked. It is fulfilled if (and only if)

\[
\frac{n}{4(n + 1)^2} \cdot (2x^o - 1) \cdot \left( A^H - A^L \right) \cdot t \geq c(x^o) - c\left( \frac{1}{2} \right) \tag{9}
\]

is met where \( t = (2nx^o + 2x^o - n) \cdot \left( A^H - A^L \right) - 2A^H \).

It might be useful to investigate the comparative static properties of the term \( t \) in (9). At fixed \( n \) and \( A^H - A^L \), let \( A^H \) increase such that the term becomes negative and, hence, inequality (9) will be violated. In this case, no non-trivial duty can be constrained efficient. Or at fixed \( A^H \) and \( A^L \), let \( n \) increase to the point where the term \( t \) becomes positive. It then depends on the shape of the cost function whether or not a constrained efficient duty exists that is non-trivial.

To sum up: if the market structure involves \( n \) Cournot competitors then a non-trivial constrained efficient duty exists if and only if the two equations (8) and (9) allow for a solution \( x^o > 1/2 \). A non-trivial duty that is constrained efficient may but need not exist if trade suffers from monopolistic or oligopolistic distortions.
4 Damages regimes

In the present section, various damages regimes will be explored. To fix ideas, imagine that the information agent is entitled to 100 percent of the producers’ surplus and that buyers can be identified as the parties other than the agent. As a consequence, buyers only will claim damages (if at all). Moreover, for the present section, I assume that the agent may shirk by investigating with insufficient effort but he cannot manipulate the signal. Rather, he is exogenously committed to the disclosure strategy $\sigma^*$.

Markets rely on the agent to investigate with due effort $x^o$. Therefore, if market structure $n$ is in place and if signal $s$ is disclosed then quantity $q_s^o = q^n(m_s(x^o, \sigma^*))$ will be traded at price $p_s^o = p^n(m_s(x^o, \sigma^*))$.

If, ex post, it turns out that the agent has been shirking by investigating insufficiently (i.e. $x < x^o$) buyers may be entitled to damages. Expectation damages and the but-for test both refer to the hypothetical situation where the agent had met his duty which actually he has not.

To deal with hypothetical uncertainty, some further assumption is needed. For illustration, I shall rule out informational gains due to shirking. More precisely, if the agent has been shirking but, nonetheless, has obtained the correct signal then, a fortiori, the hypothetical signal would have been correct as well. Alternative assumptions could be incorporated equally well.

4.1 Restitution versus expectation damages without hypothetical uncertainty

The present subsection compares restitution and expectation damages in the absence of hypothetical uncertainty. Therefore, when called in, courts can observe, not only, the true signal $s \in \{l, h\}$ obtained by the agent while shirking ($x < x^o$) and the true state of the world $S \in \{L, H\}$ but also the hypothetical signal $s^o \in \{l, h\}$ which the agent would have obtained if he had investigated with due effort $x^o$. Let $\Omega(S, s, s^o)$ denote the corresponding event. Due to the binary setting and due to the assumption of no informational gains from shirking, the following six events form a partition of the entire outcome space.

In the event $\Omega(H, h, h)$, which occurs with probability $\mu \cdot x$, the actual signal was correct and, hence, the hypothetical signal would have been correct
as well. In this event, no damages have to be awarded such that the buyers’ payoff amounts to

$$V^H(q_h^o) - p_h^o \cdot q_h^o$$

independent of the damages regime in place.

In the event $\Omega(H,l,h)$ which, under the assumption of no informational gains due to shirking, occurs with probability $\mu \cdot (1 - x^o)$ the signal was wrong but would have been correct if the agent had met his duty. In this case, the but-for test would be satisfied and the buyers are entitled to damages. Under a regime of restitution damages, buyers can decide on the quantity $q_{Hl} \leq q_h^o$ they want to keep while returning the rest $q_h^o - q_{Hl}$ to the seller, leaving them with payoff

$$\max_{q_{Hl} \leq q_h^o} V^H(q) - p_l^o \cdot q.$$ 

Notice, in the numerical example, buyers would not invoke restitution, i.e. they would choose $q_{Hl} = q_h^o$. For more general forms of marginal utility, however, they may wish to restitute even in the present event.

Still given the same event, under a regime of expectation damages, the consumers will be awarded a quantum $D^H$ of damages such that the consumers’ surplus including damages awards amounts to

$$V^H(q_h^o) - p_h^o \cdot q_h^o + D^H \geq V^H(q_h^o) - p_h^o \cdot q_h^o.$$ 

If consumers actually suffer from harm. then the above inequality will be binding. Due to trade distortions, however, it is conceivable that consumers benefit from the wrong signal by obtaining a windfall gain for free, i.e. the inequality may be strict even at zero damages.

The event $\Omega(H,l,l)$ occurs with probability $\mu \cdot (1 - x^o)$. Notice, since the hypothetical signal is wrong, the actual signal must be wrong as well. The but-for-test fails to hold and, hence, no damages are due, leaving consumers with payoff

$$V^H(q_l^o) - p_l^o \cdot q_l^o.$$ 

These are all events involving the true state $S = H$.

The three states involving the true state $S = L$ can be handled analogously. The event $\Omega(L,l,l)$ occurs with probability $(1 - \mu) \cdot x$. No damages are due and the buyers’ payoff amounts to

$$V^L(q_l^o) - p_l^o \cdot q_l^o.$$
In the event $\Omega(\omega(L,h,l))$ which occurs with probability $(1-\mu) \cdot (x^o - x)$ the but-for test is satisfied such that buyers may have valid damages claims. In fact, in a regime of restitution damages, they will end up with payoff 

$$\max_{q_{Lh} \leq q_h^o} V^L(q_{Lh}) - p_h^o \cdot q_{Lh}$$

whereas, in a regime of expectation damages they may claim damages $D^L$ such that their payoff including damages amounts to

$$V^L(q_h^o) - p_h^o \cdot q_h^o + D^L \geq V^L(q_l^o) - p_l^o \cdot q_l^o.$$

Notice, in the numerical example, buyers will keep the quantity $q_{Lh} = \max[A^L - p_h^o, 0]$ if permitted to restitute.

In the event $\Omega(\omega(L,h,l))$, finally, which occurs with probability $(1-\mu) \cdot (1 - x^o)$, the but-for test fails to hold, leaving consumers with payoff

$$V^L(q_l^o) - p_l^o \cdot q_l^o.$$

As far as incentives are concerned, only ex ante expected payoffs matter. These payoffs can easily be calculated by aggregating over the above six events. Notice, under the regime of expectation damages, the compensation principle is met in each of the six events and, hence, remains to be met from the ex ante perspective. Therefore, as follows from Proposition 2, any constrained efficient duty can be implemented under expectation damages.

Under restitution damages, however, the buyers’ payoffs are typically monotonic in the sense of Proposition 1 and, hence, (non-trivial) constrained efficient duties cannot be implemented under restitution damages. In fact, the buyers’ payoff will be a linear function of effort such that marginal payoffs are constant and, generically, different from zero.

To sum up, even in the absence of hypothetical uncertainty, restitution damages will distort the agent’s incentives while expectation damages generate correct incentives, provided that the agent’s duty is constrained efficient.

### 4.2 The all-or-nothing approach under hypothetical uncertainty

In this subsection it is assumed that courts when called in still observe the signal $s$ obtained under shirking and the true state of the world $S$ but no
longer the hypothetical signal $s^o$ that would have prevailed under due effort. In other words, they must rule under hypothetical uncertainty such that causality as a precondition for awarding damages must be dealt with in an indirect way. A threshold $\tau$ may serve as the appropriate indicator. If the updated probability of the deviation having caused harm exceeds this threshold, i.e. if

$$\frac{x^o - x}{1 - x} > \tau$$

holds then the agent’s shirking is ruled to be causal for the wrong signal but not if the updated probability is below the threshold. This causality test is satisfied if and only if

$$x < x_\tau = \frac{x^o - \tau}{1 - \tau}$$

is met. Notice, for any positive threshold $\tau > 0$, it holds that $x_\tau < x^o$. Therefore, in the range $x_\tau < x$, damages claims are denied such that, for plausible specifications of the model, the buyers’ payoff will have a positive derivative in this range. As a consequence, no matter which quantum of damages is awarded below this range, the buyers’ payoff will be monotonic in the sense of Proposition 1 and, hence, no (non-trivial) constrained efficient duty can ever be implemented if the all-or-nothing decision is based on a causality test of the above type. This rather strong impossibility result rests on the dual role played by the negligence standard which requires that the standard will actually be kept.

### 4.3 Expectation damages on average over the observed event

When courts are called in, they still face hypothetical uncertainty but are now willing to award correct expectation damages on average over the observed event.

In the notation of subsection 4.1, this means that they can distinguish neither the two events $\Omega(H, l, h)$ and $\Omega(H, l, l)$ nor the two events $\Omega(L, h, l)$ and $\Omega(L, h, h)$. In the events $\Omega(H, l, l)$ and $\Omega(L, h, h)$ which occur with probability $\mu \cdot (1 - x^o)$ and $(1 - \mu) \cdot (1 - x^o)$, respectively, zero damages would be due whereas, in the event $\Omega(H, l, h)$ occurring with probability $\mu \cdot (1 - x^o)$, the quantum $D^H$ would be due. Similarly, in the event $\Omega(L, h, l)$ which occurs with probability $(1 - \mu) \cdot (1 - x^o)$, the quantum $D^L$ would be due.
Courts now have to calculate correct expectation damages on average over the observed event. If the observed event is $\Omega(H,l,h) \cup \Omega(H,l,l)$ then average damages amount to
\[ d^H = \frac{\mu \cdot (x^o - x)}{\mu \cdot (x^o - x) + \mu \cdot (1 - x^o)} \cdot D^H = \frac{x^o - x}{1 - x} \cdot D^H \]
whereas if the event $\Omega(L,h,l) \cup \Omega(L,h,h)$ is observed average damages amount to
\[ d^L = \frac{(1 - \mu) \cdot (x^o - x)}{(1 - \mu) \cdot (x^o - x) + (1 - \mu) \cdot (1 - x^o)} \cdot D^L = \frac{x^o - x}{1 - x} \cdot D^L. \]
Since the compensation principle is met in each of the events, it will also be met from the ex ante perspective. It then follows from Proposition 2 again that any constrained efficient duty can be implemented under expectation damages if granted on average over the observed event.

5 The general setting

In the setting of the simple model studied so far, the only damages regime generally supporting constrained efficient duties of the agent was identified as awarding correct expectation damages where, if information is lacking, averages should be taken over the observed event. In the present section, a general model is introduced allowing to generalize these findings.

Uncertainty is captured by a general random move of nature $\omega \in \Omega$. The distribution of nature’s random move is exogenously given, independent from the trade decision. For simplicity, let me assume that $\Omega$ is a finite set and that, from the ex ante perspective, move $\omega$ occurs with probability $\mu(\omega)$ such that $\sum_{\omega \in \Omega} \mu(\omega) = 1$ must hold.

Agent $a$ is in charge of searching for information relevant for a trade decision $q$ from an arbitrary set $Q$ of alternatives. The trade decision affects a (finite) set $I$ of parties. Let $J = \{a\} \cup I$ denote the set of all parties, including the agent. If the move of nature is $\omega$ then the payoff (utility) of party $j \in J$ under trade decision $q$ amounts to $V_j(\omega, q)$. The agent’s function $V_a$ captures his own stake in trade.

The agent decides on effort level $x$ from a set $X$ of possible alternatives and bears effort costs $c(x)$. At effort level $x$ and move of nature $\omega$, he observes
signal \( s = S(x, \omega) \) from a set \( M \) of possible signals. At the time of trade, his effort is hidden action and the signal is his private information.

At effort \( x \in X \) and disclosure strategy \( \sigma : M \to M \), the probability of signal \( s \) being revealed to the market amounts to

\[
\pi_s(x, \sigma) = \text{prob} \, \Omega_s(x, \sigma)
\]

where \( \Omega_s(x, \sigma) = \{ \omega \in \Omega : \sigma(S(x, \omega)) = s \} \) denotes the event of \( s \) being disclosed.

If the market (market structure \( n \)) believes move \( \omega \) to occur with probability \( m(\omega) \) then the trade decision \( q^n(m(\cdot)) \in Q \) will be taken at transfer payments \( t^n(m(\cdot)) \). Transfer payments are understood as a vector with as many components as there are parties in \( J \). The \( j \)-th component refers to the payment received by party \( j \). Transfer payments are balanced, i.e. \( \sum_{j \in J} t^n_j(m(\cdot)) = 0 \) is assumed to hold.

The legal duty \( (x^o, \sigma^o) \) guides market believes in the sense that parties believe the agent to meet this duty. For these beliefs to be rational, they must be in line with Bayes’ rule. If the agent reveals signal \( s \) then the market believes the move of nature \( \omega \) to be from the event \( \Omega_s(x^o, \sigma^o) \) and assigns conditional probability

\[
m^o_s(\omega) = \frac{\mu(\omega)}{\pi_s(x^o, \sigma^o)}
\]

if \( \omega \) is from this event, and \( m^o_s(\omega) = 0 \) else. As a consequence, if the agent discloses signal \( s \) then the quantity \( q^o_s = q^n(m^o_s(\cdot)) \) will be traded at transfer payments \( t^o_s = t^n(m^o_s(\cdot)) \).

The legal duty \( (x^o, \sigma^o) \) also serves as a reference point for calculating expectation damages. To begin with, suppose that courts, ex post, can observe the move of nature. Moreover, due to their investigative prowess, courts are assumed to know the true effort \( x \) as well as the actual disclosure strategy \( \sigma \) of the agent. Then they will award expectation damages to party \( i \in I \) amounting to

\[
D_i(\omega, x, \sigma; x^o, \sigma^o) = \max \left[ V_i(\omega, q^o_s) + t^o_{s,i} - \left( V_i(\omega, q^o_s) - t^o_{s,i} \right), 0 \right]
\]

where \( s = \sigma(S(x, \omega)) \) and \( s^o = \sigma^o(S(x^o, \omega)) \) denote the signal actually disclosed and the hypothetical signal, respectively, that would have been
disclosed if the agent had met his duty. The corresponding expected surplus amounts to
\[ \gamma(x, \sigma; x^o, \sigma^o) = \sum_{j \in J} E \left[ V_j \left( \omega, q_{\sigma(S(x, \omega))}^o \right) \right] - c(x) \]
whereas the aggregate expected payoff of parties I amounts to
\[ \psi(x, \sigma; x^o, \sigma^o) = \sum_{i \in I} E \left[ V_i \left( \omega, q_{\sigma(S(x, \omega))}^o \right) + D_i(\omega, x, \sigma; x^o, \sigma^o) \right] \]
and is easily seen to satisfy the compensation principle \( \psi(x, \sigma; x^o, \sigma^o) \geq \psi(x^o, \sigma^o; x^o, \sigma^o) \) for any deviation \((x, \sigma)\) from the agent’s duty \((x^o, \sigma^o)\).

This duty is implementable under expectation damages if the agent has the incentive to meet his duty, i.e. if
\[ (x^o, \sigma^o) \in \arg \max_{(x, \sigma)} \gamma(x, \sigma; x^o, \sigma^o) - \psi(x, \sigma; x^o, \sigma^o) \]
holds. Moreover, the agent’s duty is constrained efficient if it maximizes the expected surplus, i.e. if \((x^o, \sigma^o) \in \arg \max_{(x, \sigma)} \gamma(x, \sigma; x^o, \sigma^o)\). The following proposition can be established by the same argument as in Proposition 2.

**Proposition 4** Under expectation damages, the compensation principle is met. Therefore, if the agent’s duty is constrained efficient then it can be implemented under expectation damages.

So far, I have assumed that, ex post, courts know the hypothetical signal. If they do not, they should still award correct damages along the above line though, for lack of observability, on average over the observed event. Due to Bayes’ rule, the compensation principle remains to be satisfied and, hence, constrained efficient duties can still be implemented under expectation damages, even if courts do not know the hypothetical signal for sure.

As in the simple model, the first best solution can always be implemented if correct expectation damages on average over the observed event are awarded. If, however, the trade decision is distorted providing correct incentives proves more demanding. By disclosing information dishonestly, the trade decision may be affected in a way which reduces the distortion from market imperfections. As a consequence, the agent’s duty may fail to be constrained efficient which, in turn, may affect his incentives to investigate duly and to report honestly.
6 Concluding remarks

As a starting point, I have briefly discussed some of the legal rules in place concerning damages for breach of duty in corporate disclosure. I take from the writing of legal scholars that many issues remain unsettled. Courts are hesitating to give up the all-or-nothing approach even if it is at odds with the compensation principle. The main alternative remedies seem to be expectation versus restitution damages. The exact circumstances, however, under which these remedies will be granted are by far less clear.

As a general principle, it is known from the law and economics literature that the compensation principle is closely related to precaution incentives. The present paper spells out details of this principle if applied to a situation where the agent’s duty serves as a reference point for quantifying expectation damages and the but-for test and, at the same time, guides the beliefs of market participants with respect to the agent’s behavior.

The present paper borrows from the mechanism design approach, in particular from basic insights behind mechanisms of the Vickrey-Clarke-Groves type. These mechanisms are driven by making parties residual claimants with respect to their own decisions. While a regime of expectation damages need not make the agent residual claimant in the strict sense, the other party is never worse off which, in turn, strengthens the incentives even more.

The paper has shown that expectation damages which, in case of hypothetical uncertainty, are taken on average over the observed event satisfy the compensation principle and, hence, generate incentives for the agent to meet constrained efficient duties. In Schweizer (2008), I have argued along similar lines in favor of legal damages for losses of chances. While medical malpractice has served as illustration in the earlier paper, correct expectation damages on average over the observed event turn out to perform equally well if corporate disclosure is at stake. As a novel aspect, the dual role of negligence standards comes in.

7 References


